

*Boechera horizontalis* ("Crater Lake Rockcress"):  
Inventory on a Rare Species  
Crater Lake National Park  
Summer 2011

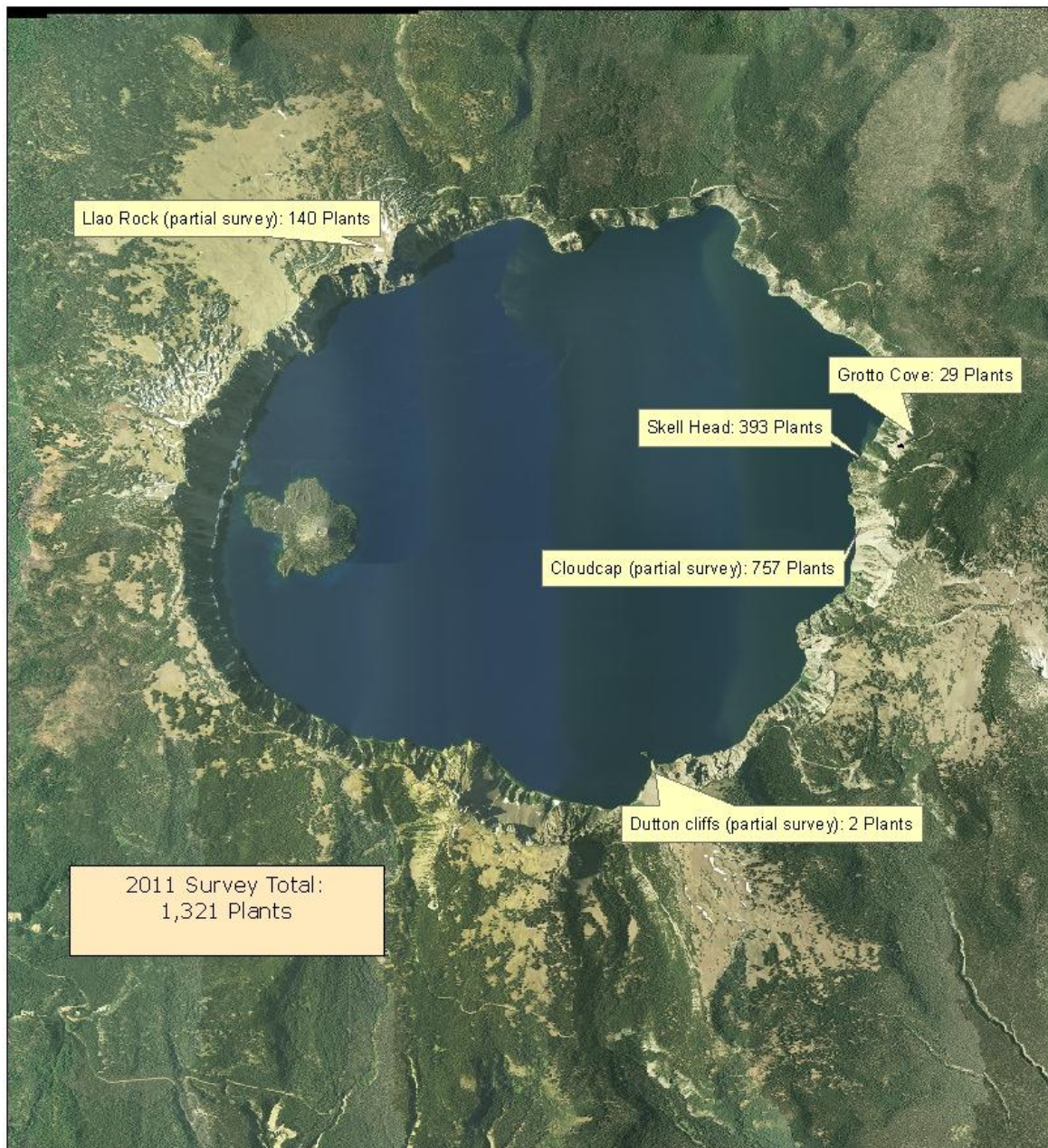
*Kathryn Williams*  
*Botany Technician, Crater Lake National Park*



# Crater Lake National Park

## Boechera horizontalis Locations, 2011 Surveys

National Park Service  
U.S. Department of the Interior



The National Park Service shall not be held liable for improper or incorrect use of this map and/or the data contained herein. No warranty is expressed or implied as to accuracy, reliability, or completeness.

August 9, 2011  
S:\Terrestrial\Boechera\Boechera\2011\2011.mxd



1 inch = 1.07 miles

1:67,657

0 0.5 1 2 Miles

Map Projection:  
UTM Zone 10 North, NAD 83



## INTRODUCTION

It had been nearly 20 years since an inventory of the Crater Lake rockcress had been attempted in a comprehensive way. The last time the Park had a record of a thorough search was in 1993 when Vander Schaaf found 68 *Arabis suffrutescens* var. *horizontalis* plants (now classified as "*Boechera horizontalis*") in four locations, plus an estimated "30 more at one site for a combined total of 98 plants" (see Table 1 for a look at a history of Crater Lake rockcress searches). The completion of Linda Ann Vorobik's paper, "Observations on the comparative morphology of *Boechera horizontalis* (Greene) Windham & Al-Shehbaz and some of its nearest relatives" in 2010 prompted us to take a close look at this rare species in 2011. Armed with new genetic information (see next section), Vorobik's new comparative species information and help from local botanist and *Arabis*/*Boechera* expert Wayne Rolle, we were poised to take this new information into the field to try and answer the question "Where are the current populations of *B. horizontalis* located, and how strong are their numbers?" Our hope was to get a current picture of this species' range and densities, and come up with new conservation strategies, if necessary.



*B. horizontalis*:  
Basal leaf surfaces densely pubescent



Presence of auricles (*B. horizontalis*)



Most distinctive  
feature: horizontal to  
descending fruits  
(*B. horizontalis*)





Flower color. The Flora of North America key states, "... petals lavender to purple." In the field, we have only observed a darker purple color (*B. horizontalis*).



Potential point of confusion: Before fruits are fully mature, they may display a temporary ascending orientation, as seen towards this plant's apex (*B. horizontalis*).

## REVIEW OF RECENT LITERATURE

The Crater Lake rockcress (*Boechera horizontalis*) is endemic to Crater Lake National Park found only at a several locations along the rim of the caldera, often in open pumice fields - a habitat that it often shares with another rarity, the pumice moonwort (*Botrychium pumicola*). *Boechera horizontalis* ("Boehor") has been called by other names in the past (i.e., *Arabis horizontalis*; *Arabis suffrutescens* var. *horizontalis*) beginning with its first reported sighting by Elmer Applegate in 1897. Recent re-evaluation of the genus *Arabis* has divided out into two camps: *Arabis* (basic chromosome number = 8) and *Boechera* (basic chromosome number = 7). Preliminary genetic testing and morphological and distributional comparisons gave rise to a reassignment of species nomenclature to some species (Windham and Al-Shehbaz, 2007). Further, as yet unpublished genetic testing continued by Windham revealed the parentage of *B. horizontalis* as a cross between *B. lemmonii*, *B. suffrutescens* and *B. lyallii* (Vorobik, 2010). This makes sense as all three of these species are found together up at Cloudcap, its possible place of origin. Windham further hypothesized that the yet-to-be-formally-described *Boechera* plant with an ascending fruit orientation and glabrate/glabrous basal leaves (which has, given our current understanding, been mistakenly lumped in with *Arabis suffrutescens* var. *horizontalis* in the past) is actually a sexual diploid, and may be the "stepping stone" species to the development of *B. horizontalis*, as it is a hybrid (apomictic diploid) between two of Boehor's parents, *B. lyallii* and *B. suffrutescens* (Vorobik, 2010). In this report, we will refer to this unnamed hybrid as the "undescribed *Boechera*".

There are a couple of corrections to Vorobik's 2010 *Boechera* comparison paper that have come to light with recent genetic testing. In the past, the undescribed *Boechera* had been lumped in some publications with *B. horizontalis* as a morphological variation of the same species (e.g., "Threatened and Endangered Vascular Plants of Oregon: An Illustrated Guide, Meinke, 1982). As we mentioned in the previous paragraph, recent genetic testing has shown that it is similar in parentage to *B. horizontalis* but that it lacks one of the progenitors found in *B. horizontalis*' DNA. Therefore, if one is using the high-resolution photographs, or the comparison chart (Table 3) in the 2010 comparison report by Vorobik, the photos and characteristics of the undescribed form must be teased out of the report. In other words, the "Observed differences" listed on page two are actually referring to the undescribed *Boechera*, and the photo in Figure 4b is a picture of the undescribed *Boechera*, not *B. horizontalis*. As for an updated comparison chart, K. Williams made a revised one later in 2010 (unpublished).

## METHODS

Areas where *B. horizontalis* had been previously seen were considered first. Early snowmelt at Grotto Cove and Skell Head put those areas first on our agenda. Areas

were inventoried systematically, taking into account local topography for easily described survey boundaries. Pin flags were used to mark Boehor plants in the field. Once an area was inventoried, photos were taken, both with and without identifying labels (S:\....\Boechera\). Finally, pin flags were collected as field personnel georeferenced plant locations (NAD 83, Zone 10). Data were used to create GIS maps.

## RESULTS

Due to time constraints, we were only able to inventory a few areas for Boehor, but we searched them thoroughly; exceptions are detailed below. The following is information found at the areas inventoried for Boehor in 2011.

**Table 1. Historic Crater Lake National Park locations for *Boechera horizontalis* (*Arabis suffrutescens* var. *horizontalis*)**

<b>Victor View</b>	<u>1989</u> : First located, 7 plants seen. <u>1993</u> : 8 plants seen on west-facing slope below social trail. Both in 1989 & 1993, plants seen below auto pull-out on a narrow ridge running WNW down towards caldera. <u>2010</u> : Saw Boehor in pullout island; may have seen plants just W (caldera side of pullout). <b>2011: Not surveyed</b>
<b>Cloudcap</b>	<u>1989</u> : First located; Estimated 200+ plants. <u>1993</u> : ~25 plants seen in four sites, including in center of parking loop, in areas facing AND away from caldera, and in flat spots. <u>2010</u> : Saw Boehor, <i>B. platysperma</i> , undescribed form, <i>B. lyallii</i> , <i>B. hobeii</i> ; Refer to "Field Notes" from August 2010 field trip led by Wayne Rolle. <b>2011: Plants found = 757</b>
<b>Skell Head Observation Turnout</b>	<u>1989</u> : Found in turnout island, < 1ft from pavement; assumed few plants, no actual counts given. <u>1993</u> : No plants seen. <b>2011: Plants found = 393</b>
<b>Grotto Cove</b>	<b>2011: Plants found = 29</b>
<b>Garfield Trail (Castle Crest)</b>	<u>1918</u> : Herbarium collection (Heller), last sighting near summit. <u>1993</u> : Unclear, but it does not seem that any were sighted that year as there was no finite population size given. <b>2011: Not surveyed.</b>
<b>Mt. Scott</b>	<u>1935</u> : Sighting at summit saddle. <u>1993</u> : 15 plants found in two locations. <b>2011: Not surveyed.</b>
<b>Llao Rock</b>	<u>1986</u> : First located, Rolle & Vorobik, 26 plants. <u>1993</u> : Not relocated, but admitted that they may have missed the population entirely, as the area is large. <u>2009</u> : 64 plants found (Rolle). <b>2011: Informal, incomplete survey (due to snow &amp; time constraints). At the top saddle of Llao, 140 plants found.</b>
<b>Dutton Ridge</b>	<b>2011: Informal survey on open slopes near Botrychium plots located 2 plants.</b>

<b>Hillman Peak</b>	<u>1993</u> : Extensive search found no plants, but the report had hinted that Boehor had been found there in the past. <b>2011: Not surveyed.</b>
---------------------	---

Total *B. horizontalis* tallied:

1993: Approximately 98 plants

2011: 1,321 plants

### **Grotto Cove**



Grotto Cove, between the two pullouts, facing south.

**Number of *B. horizontalis* plants found:** 29\*

**Dates of surveys:** July 6, 2011

**Areas surveyed:**

From north to south pullout, the open cliffs facing the lake, the walkway "island", and the east side of the road.

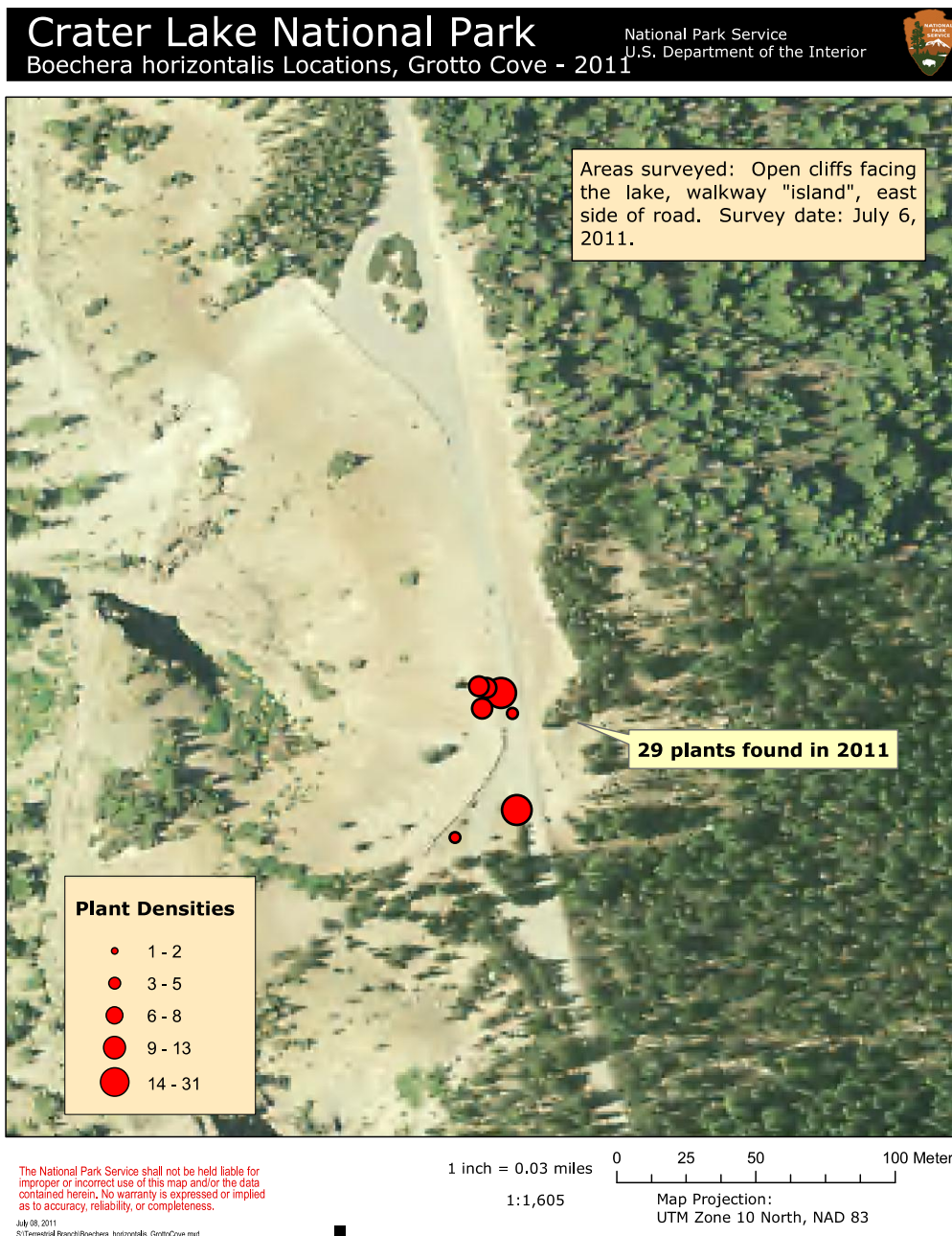
**Special Management Concerns:**

Plants next to road and walkway.

**Other *Boechera* species in survey area:** *B. lemmonii*, *B. suffrutescens*



\* A few more *Boehor* plants were seen later in the season after the snow melted (south of the officially surveyed area, under tree cover) - these plants were not included in the 2011 tally.



## Skell Head



Skell Head walkway, looking north. Example of perilous location of some *B. horizontalis* plants.





Skell Head, east side of East Rim Road. Just outside of frame on the right we stopped surveying, as the slope and vegetation changed and we had limited time.

**Number of *B. horizontalis* plants found:** 393

**Dates of surveys:** July 1, 6, and August 10, 2011

**Areas surveyed:**

Open slopes facing the lake, in parking island, on north edge of pullout, and on east side of East Rim Road (the length of the pullout from the road margin to approximately 20 feet east, where the eastward sloping begins.)

**Special Management Concerns:**

Plants in walkway and road cracks; plants next to road.

**Other *Boechera* species in survey area:** *B. lemmonii*, *B. sp.*

**Comments:** More Boehor plants were seen growing downslope out of the inventory area on the east side of East Rim Road, as the road margin vegetation starts to slope eastward.

# Crater Lake National Park

## Boechera horizontalis Locations, Skell Head - 2011

National Park Service  
U.S. Department of the Interior



Areas surveyed: Open slopes facing lake, in parking island, on north edge of pullout and on east side of East Rim Road (the length of the pullout from the road margin to approximately 20 ft east where the eastward sloping begins). Survey dates: July 6, and August 10, 2011.

393 plants located in 2011

### Plant Densities

- 1 - 2
- 3 - 5
- 6 - 8
- 9 - 13
- 14 - 31

The National Park Service shall not be held liable for improper or incorrect use of this map and/or the data contained herein. No warranty is expressed or implied as to accuracy, reliability, or completeness.

August 18, 2011  
S:\Terrestrial Branch\Boechera\_horizontalis\_SkellHead.mxd

1 inch = 0.05 miles

1:3,112

0 45 90 180 Meters

Map Projection:  
UTM Zone 10 North, NAD 83



## Cloudcap



Cloudcap, south of rock wall, facing west.



Cloudcap cliffs, looking to the west.

**Number of *B. horizontalis* plants found:** 757  
**Dates of surveys:** July 20, 22, and August 3, 2011  
**Areas surveyed:**  
Unforested slopes facing the lake; the parking island.  
**Special Management Concerns:**  
Social trail; plants next to road; High-visitor use area.  
**Other *Boechera* species in survey area:** *B. lemmonii*, *Undescribed Boechera*,  
*B. sp.*

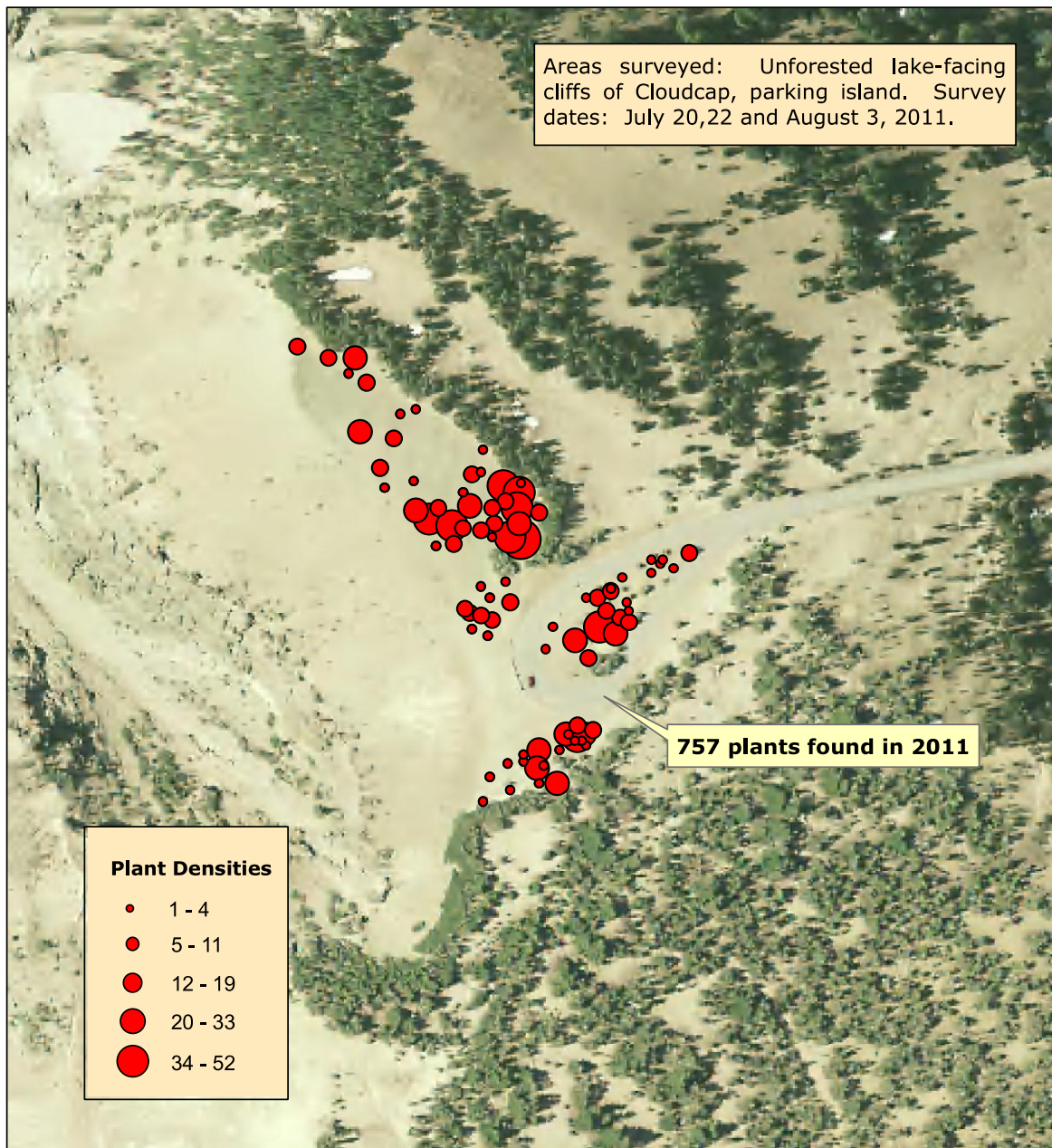
**Comments.** Due to heavy snow, we had to limit our research area to the locations described above. Previous searches for Boehor located plants outside of our 2011 inventory area on Cloudcap. This is an interesting area in which to compare *Boechera* species, as the area supports at least four.



# Crater Lake National Park

## Boechera horizontalis Locations, Cloudcap - 2011

National Park Service  
U.S. Department of the Interior



The National Park Service shall not be held liable for improper or incorrect use of this map and/or the data contained herein. No warranty is expressed or implied as to accuracy, reliability, or completeness.

July 08, 2011  
S:\Terrestrial Branch\Boechera\_horizontalis\_Cloudcap.mxd

1 inch = 0.03 miles

1:2,201

0 30 60 120 Meters

Map Projection:  
UTM Zone 10 North, NAD 83

### **Dutton Ridge – limited survey**

**Number of *B. horizontalis* plants found:** 2  
**Dates of surveys:** August 15, 2011  
**Areas surveyed:**  
Along caldera edge (to approx. 15ft deep) , SW of Botpum area.  
**Special Management Concerns:**  
This appears to be a very small population. Fortunately, foot traffic seems to be minimal.  
**Other *Boechnera* species in survey area:** *B. sp.*

**Comments.** Dutton ridge was not high on our priority list, but since we were up there for pumice moonwort work, we wanted to spend half-an-hour scanning along the caldera edge for any signs of Boechnera. We found two plants, one near the cliff's edge (N4750268, E0574635), and one further back (N4750259, E0574654).

### **Llao Rock – limited survey**

**Number of *B. horizontalis* plants found:** 140  
**Dates of surveys:** July 26, 2011  
**Areas surveyed:** Llao Rock saddle.  
**Special Management Concerns:**  
Social trails at summit.

**Other *Boechnera* species in survey area:** *B. sp.*

The upper slope/saddle of Llao Rock was inventoried on July 26<sup>th</sup>, 2011. Due to the vastness of the northern slopes and late snowmelt there, this area was not censused in 2011. Rather, two field personnel returned on August 24<sup>th</sup> to try and get a sense of the Boechnera footprint on the remaining, unsurveyed northern slopes of Llao. GPS tracks marking the basic outline of Llao's Boechnera populations remain unassessed on the shared botany desk hard drive. The lowest-most patch of Llao Boechnera was found here (N4758464, E0570472). On the July survey date, Boechnera on the saddle were found in flower and in fruit, while the north face of Llao remained to a great extent covered in snow.

## **DISCUSSION**

The winter and spring of 2011 was a record-breaking snow year. Heavy late-season storms kept snow on the ground in Crater Lake National Park far into the summer, well beyond any other summer since the 1920s. My personal fear was that with such a heavy snowfall there wouldn't be any significant botanical work to do until well into the summer. As it turned out, the snow on the slopes east side of the caldera was quite shallow compared to other locations around the caldera rim, and we actually



found *B. horizontalis* plants in fruit at Skell Head as early as July 1<sup>st</sup>. It would seem that Boehor gets straight to the task of growing as soon as the snow melts and appeared to be one of the first plants (including other *Boechera*) to flower and fruit in their communities (personal observations). I believe this might be why earlier inventory work on this species revealed far fewer plants. If an area is inventoried too early, the fruits may not yet be mature enough for identification. If an area is searched too late, brittle fruits may have broken off of the plant, or perhaps browsed by deer, leaving behind merely the basal leaves, which aren't enough information for positive identification. In order to best inventory *B. horizontalis*, field personnel have to be there at just the right time in its growth cycle. This often requires multiple trips to an area to check on snow melt and phenology. The few areas censused in 2011 revealed more *Boechera horizontalis* plants than had ever been reported.

It appears that the 1993 crew performed a majority of their surveying in August – I would argue that perhaps their findings were so meager that year because they began the search too late. Although the crew did find some *B. horizontalis* plants in flower, I suspect that they found late-blooming individuals and that they missed an entire cohort of plants that emerged just post-snowmelt. The 2011 botanical crew began surveying in early July – and it was a record snowpack year. I suspect that our 2011 Boehor search was far more fruitful than previous ones due to our early-season surveying.

Given the rarity of *Boechera horizontalis*, it is important to protect its populations. Good communication with Roads, Trails and fire crews regarding projects in Boehor growing areas may prevent accidental plant and habitat damage. Banking Boehor seed would provide further insurance for the survival of the species. Surveying the high-priority areas that were missed in 2011 would help bring a fuller picture of the health of the Crater Lake rockcress, in addition to perhaps re-surveying a location inventoried in 2011 to see if there are any interesting annual fluctuations.

### Bibliography

Meinke, Robert J. 1982. Threatened and Endangered Vascular Plants of Oregon: An Illustrated Guide. Portland, Oregon: U.S. Fish and Wildlife Service, Region 1. 326p.

Vander Schaaf, Dick. 1993. Inventory for Crater Lake Rockcress *Arabis suffrutescens* Wats. variety *horizontalis* (Greene) Roll, a rare endemic plant species. Portland, Oregon: The Nature Conservancy. 11p.

Vorobik, Linda Ann. 2010. Observations on the comparative morphology of *Boechera horizontalis* (Greene) Windham & Al-Shehbaz and some of its nearest relatives. Report submitted to Rogue-Siskiyou National Forest, Oregon. 19p.

Windham, M.D. and I.A. Al-Shehbaz. 2007. New and noteworthy species of *Boechera* (Brassicaceae)II: Apomictic hybrids. Harvard Pap. Bot 11:22 257-274.